ABSTRACT OF THE DISCLOSURE

Multiwall (e.g., double wall) permreactor and permreactor-separator processes by integrating reaction and separation operations in one reactor with increased reactant conversion and synthesis gas yield and internal flow stream recycling, by defining more than one catalytic zones, and by employing more than one membranes made by different materials, for the catalytic in-situ conversion of methane and higher hydrocarbons, alcohols, natural gas, coal- landfill- sewage- and biomass gases, and other flue and waste mixtures of methane and higher hydrocarbons and alcohols, based on the reforming reactions of these feedstocks with steam and carbon dioxide.

Final exit streams from the described gas phase processing reactors and reaction-separation systems, contain pure hydrogen or synthesis gas (hydrogen and carbon monoxide, hydrogen and carbon dioxide mixtures), and can be used as direct feed in molten carbonate, solid oxide, proton exchange membrane, alkaline, phosphoric acid and related types of hydrogen driven fuel cells as well as in gas turbines and engines for generation of power or electric current.